

WE CLAIM:

1. An integrated lighting module comprising:
 - (a) one or more light-emitting elements for generating illumination;
 - 5 (b) an optical system optically coupled to the one or more light-emitting elements for manipulating the illumination;
 - (c) a feedback system for collecting information representative of operational characteristics of the one or more light-emitting elements, said feedback system generating one or more signals representative of said information;
 - 10 (d) a thermal management system in thermal contact with the one or more light-emitting elements, said thermal management system for conducting heat away from the one or more light-emitting elements;
 - (e) a drive and control system receiving the one or more signals from the feedback system, said drive and control system regulating input power and generating and sending control signals to the one or more light-emitting elements, said control signals generated based on predetermined control parameters and said one or more signals.
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2. The integrated lighting module according to claim 1, wherein the thermal management system includes one or more heat pipes or thermosyphons, each heat pipe or thermosyphon having an evaporator end.
- 20 3. The integrated lighting module according to claim 2, wherein the one or more heat pipes or thermosyphons are physically connected to one or more of the one or more light-emitting elements.
- 25 4. The integrated lighting module according to claim 2, wherein the one or more light-emitting elements are mounted on a thermally conductive substrate and wherein the one or more heat pipes or thermosyphons are in direct thermal contact with the thermally conductive substrate.
- 30 5. The integrated lighting module according to claim 4, wherein the evaporator end of one of the one or more heat pipes or thermosyphons is integrated into the thermally conductive substrate.

- 5 6. The integrated lighting module according to claim 1, wherein the thermal management system comprises one or more thermal devices selected from the group comprising a Peltier-effect thermoelectric cooling device, a thermionic device, and a fluid cooling system.
- 10 7. The integrated lighting module according to claim 2, wherein the thermal management system further comprises one or more heat sinks thermally connected to the one or more heat pipes or thermosyphons, said one or more heat sinks for dissipating the heat transferred thereto by the one or more heat pipes or thermosyphons.
- 15 8. The integrated lighting module according to claim 1, wherein the feedback system includes one or more optical sensors configured to generate signals representative of the illumination generated by the one or more light-emitting elements, said signals representative of any one or more characteristics selected from the group comprising illumination colour, illumination correlated colour temperature and illumination intensity.
- 20 9. The integrated lighting module according to claim 1, wherein the feedback system includes one or more temperature sensors configured to generate signals representative of operational temperature of the one or more light-emitting elements.
- 25 10. The integrated lighting module according to claim 8, wherein the feedback system further comprises a temperature sensor configured to generate signals representative of operational temperature of the one or more optical sensors.
- 30 11. The integrated lighting module according to claim 1, wherein one or more of the one or more optical sensors are further configured to generate signals representative of ambient light conditions.

12. The integrated lighting module according to claim 8, wherein the one or more optical sensors include a colour filter, said colour filter for limiting optical sensor response to a predetermined range of wavelengths.
- 5 13. The integrated lighting module according to claim 8, wherein the one or more optical sensors are interfaced with circuitry adapted to manipulate the signals generated by the one or more optical sensors, wherein manipulation of the signals includes one or more of signal conditioning, signal amplification, gain control and integration time control.
- 10 14. The integrated lighting module according to claim 1, wherein the one or more light-emitting elements are electrically connected for individual control thereof by the drive and control system.
- 15 15. The integrated lighting module according to claim 1, wherein the one or more light-emitting elements emit light having a colour selected from the group comprising: white, red, green, blue, cyan and amber.
- 20 16. The integrated lighting module according to claim 1, wherein the drive and control system digitally controls the one or more light-emitting elements using either pulse width modulation or pulse code modulation.
- 25 17. The integrated lighting module according to claim 1, wherein the drive and control system includes a switching converter operatively coupled to selected light-emitting elements of the one or more light-emitting elements, said switching converter providing a means for regulating current to the selected light-emitting elements based on a detected voltage drop across the selected light-emitting elements.
- 30 18. The integrated lighting module according to claim 1, wherein the drive and control system and the one or more light-emitting elements are mounted on a common thermally conductive substrate, wherein the thermal management system further provides a means for conducting heat away from the drive and control system.

19. The integrated lighting module according to claim 1, wherein the drive and control system is operatively connected to a user interface thereby providing a means for a user to modify the illumination generated by the integrated lighting module.
20. The integrated lighting module according to claim 1, wherein the optical system includes one or more optical elements configured to manipulate the illumination from the one or more light-emitting elements, wherein manipulation includes one or more of light extraction, light collection, light collimation and light mixing.
21. The integrated lighting module according to claim 8, wherein the optical system comprises an optical element for capturing and directing a portion of the illumination to the one or more optical sensors.
22. The integrated lighting module according to claim 1, further comprising a communication system operatively connected to the drive and control system, said communication system enabling one or both of data input to the lighting module or data output from the lighting module.
23. A networked lighting system comprising:
- (a) two or more integrated lighting modules, each module including:
 - (i) one or more light-emitting elements for generating illumination;
 - (ii) an optical system optically coupled to the one or more light-emitting elements for manipulating the illumination;
 - (iii) a feedback system for collecting information representative of operational characteristics of the one or more light-emitting elements, said feedback system generating one or more signals representative of said information;
 - (iv) a thermal management system in thermal contact with the one or more light-emitting elements, said thermal management system for conducting heat away from the one or more light-emitting elements;

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(v) a drive and control system receiving the one or more signals from the feedback system, said drive and control system regulating input power and generating and sending control signals to the one or more light-emitting elements, said control signals generated based on predetermined control parameters and said one or more signals; and

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(vi) a communication system operatively connected to the drive and control system, said communication system enabling communication between the two or more integrated lighting modules.